

## 2017 USAFRI Research Project Objectives

### Enhancing Alfalfa Yields and Stand Life by Improving Management of Seed Rot and Seedling Damping Off USDA-ARS - Samac

Project Award: \$36,000

#### Justification:

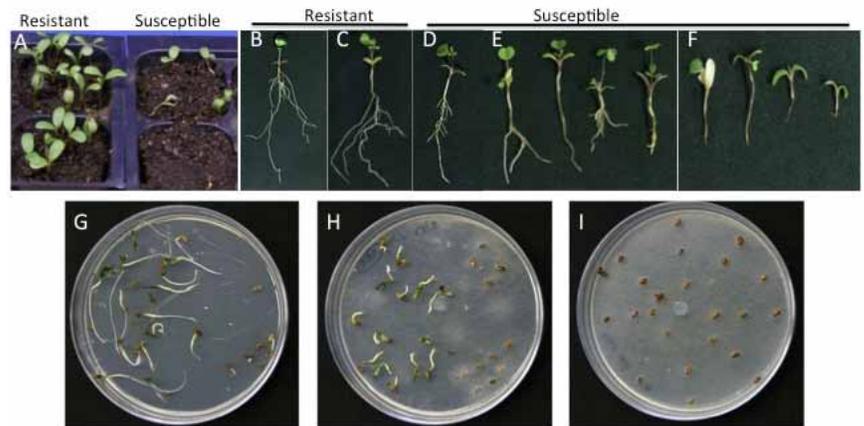
- Rapid and uniform seedling emergence is critical for obtaining a productive and persistent stand of alfalfa. In many locations, alfalfa seeds are planted into cold, wet soil conditions that are ideal for seed rot and damping off to occur. A complex of soil-borne pathogens including *Pythium* spp., *Rhizoctonia solani*, *Phytophthora medicaginis*, and *Fusarium* spp. cause seed rot and damping-off of alfalfa seedlings (1, 2). Infection of mature plants during wet spring weather causes destruction of fine feeder roots, which interferes with nitrogen fixation, nutrient uptake from the soil, and water absorption. Injury to the root may cause root “forking” in which shallow adventitious roots form above the damaged primary root (2). Cumulatively, these seedling and adult diseases result in reduced yields, decreased winter survival, and shortened stand life. The goal of this project is to develop new tools for producers to manage these diseases and obtain higher yields per acre over a longer period of time.

Damping-off of alfalfa (Figure 1) is managed by over-seeding to offset seed and seedling losses and fungicide seed treatments. Apron XL is widely used as a seed treatment and offers protection from *Pythium* spp. and *Phytophthora* spp. It is not effective against the other organisms causing seed rot and damping off or the seedling disease Aphanomyces root rot. Recently, we isolated aggressive *Pythium* strains from Minnesota alfalfa fields that were not controlled by

Apron XL or Stamina seed treatments (3). We also isolated highly aggressive *Fusarium* strains causing alfalfa seed rot. We expect that such aggressive *Pythium* isolates occur in other states. A recent survey of seedling damping off and root rot pathogens of soybean found highly aggressive *Pythium* isolates throughout the soybean producing areas (4). Many *Pythium* species attack both alfalfa and soybean. A wide array of fungicides have been labeled for use on soybean and other legume crops that are treated with rhizobial inoculants. We propose to test fungicides for their activity against seed rot and seedling damping off pathogens of alfalfa to identify new seed treatments for alfalfa. We will also investigate the activity of new microbiological seed treatments for managing diseases of alfalfa seedlings.

Most diseases of alfalfa are managed using resistant cultivars. Large gains in alfalfa yields were obtained in the 1970s and 1980s by developing disease resistant germplasm and stacking resistance to multiple diseases and pests. Previously, it was shown that alfalfa seedlings can be selected for resistance to seed rot and damping off in a culture plate assay (5) and that significant progress can be made in a single cycle of selection (6). We have made selections in three germplasms for resistance to *Pythium* strains and are currently producing seeds from the resistant selections. A cultivar with

**Figure 1.** Damping off of alfalfa. A, Seedlings protected from disease (left) and unprotected (right). B and C, resistant plants. D, E, and F, Susceptible plants. Note root “forking” in E. G, healthy plants in a plate assay. H, diseased plants. I, seed rot.



resistance to this pathogen would have greater potential seedling establishment and improved adult plant root health, which will increase crop productivity.

This research should result in identification of fungicides with activity against major seed rot and seedling damping off pathogens of alfalfa. The next phase of work would be to test them as seed treatments under field conditions to measure improvements in stand establishment. Because the fungicides to be tested in the proposed work are registered for other legume crops, the labels could be expanded to include alfalfa. Almost all alfalfa seed is currently treated with ApronXL by seed producers/marketers. If a more effective fungicide or combination of fungicides is identified, they could rapidly be deployed for use. The alfalfa germplasm that we produce will be released for use by the commercial seed industry and the methodology published so that it can be adopted in breeding programs. A standard test for *Pythium* seed rot and seedling damping off has been approved by the North American Alfalfa Improvement Conference (7), facilitating registration of cultivars with this trait. Thus, the results of the research can be rapidly applied to forage operations.

#### Objectives:

- The objectives of this project are to 1) Evaluate sensitivity of seed rot and damping-off pathogens and *Sinorhizobium meliloti* used for inoculation of alfalfa to fungicides and biological agents; 2) Test efficacy of fungicides and biologicals when used as seed treatments for control of seed rot and damping off of alfalfa, and 3) Measure disease resistance in experimental germplasm that has undergone one cycle of selection for resistance to *Pythium* species causing seed rot and damping off.